Intramedullary Primitive Neuroectodermal Tumor Presenting With Rapidly-Progressive Cauda Equina Syndrome
—Case Report—

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Abstract

A 39-year-old male presented with gait disturbances with rapid deterioration for 2 weeks. Neurological examination found paraparesis, sensory loss in the L1-S5 dermatomes, and vesicorectal dysfunction. Magnetic resonance (MR) imaging revealed a fusiform intramedullary tumor at T12-L1 levels with heterogeneous enhancement. The patient underwent microsurgical tumor resection. A myelotomy exposed a highly vascular tumor that was subtotally resected. Histological examination demonstrated hypercellular tumor accompanied by significant cell atypism and mitotic figures. Immunohistochemical staining was positive for glial fibrillary acidic protein, S-100 protein, synaptophysin, and INI-1, consistent with primitive neuroectodermal tumor (PNET). Postoperatively, the patient underwent irradiation to the whole craniospinal axis. He experienced local recurrence 7 months after surgery. MR imaging performed at 10 months revealed holocord progression and intracranial dissemination. The patient died 13 months after the onset of the disease. PNET should be considered in the differential diagnosis of an intramedullary spinal cord tumor.

Key words: primitive neuroectodermal tumor, spinal intramedullary tumor, cauda equina syndrome, treatment

Introduction

Central nervous system primitive neuroectodermal tumors (PNETs) are a heterogenous group of tumors, classified into World Health Organization grade IV. These tumors, which predominantly affect children and adolescents, may arise in the cerebral hemispheres, brainstem, or spinal cord. Histologically, the tumors contain undifferentiated or poorly differentiated neuroepithelial cells that can display divergent differentiation along neuronal, astrocytic, and ependymal lineages. Primary intraspinal PNET is an uncommon entity. Intradummary PNET is even more rare and has been documented primarily as case presentations and short series.

Cauda equina syndrome refers to a constellation of symptoms that result from damage to the cauda equina. This syndrome may present as sciatica, low-back pain, saddle analgesia, decreased rectal tone, absent bulbocavernosus, patellar, and Achilles reflexes, bowel and bladder dysfunction, and lower extremity weakness. Causative pathology includes lumbar disk herniation, arachnoiditis, hemorrhage, trauma, and neoplasm.

Here we describe a case of pure intramedullary PNET arising in the lumbosacral cord that presented in an adult with rapidly progressing cauda equina syndrome.

Case Report

A 39-year-old male was found to suffer from gradual deterioration and gait disturbances for one month, which rapidly progressed during the next 2 weeks to involve urinary and fecal incontinence. His medical history was notable for the absence of lumbar disk hernia, infectious diseases affecting the central nervous system, cerebrospinal vascular disease, trauma, or neoplasm. The patient was referred to our department under suspicion of a spinal cord tumor by a local urologist. Neurological examination revealed predominantly left paraparesis, profound sensory loss in the L1-S5 dermatomes and saddle anesthesia, as well as significant left sciatica induced by knee extension. The deep tendon reflexes were depressed in both lower extremities. Rectal tone was severely impaired with significant urinary retention and constipation. Cerebral mag-
Fig. 1 Sagittal and axial magnetic resonance images demonstrating a poorly circumscribed, fusiform-shaped, and eccentrically located intramedullary tumor at the T12-L1 levels (arrowheads), appearing hyperintense on both T1- and T2-weighted images with heterogeneous enhancement after gadolinium infusion (Fig. 1).

The patient underwent emergent microsurgical tumor resection following laminotomy of T12 and L1. Motor evoked potentials were used as intraoperative electrophysiological monitoring. After incising the dura mater, the dorsal part of the swollen epiconus and conus medullaris was exposed, and appeared intact (Fig. 2 upper). A midline myelotomy was made in the posterior median raphe to expose the tumor, which was grayish, soft in consistency, and highly vascular, and extended 2 mm from the pial surface. The tumor was located primarily in the conus medullaris with partial extension into the epiconus. The tumor was dissected circumferentially, with infiltrative findings in some regions, but the gliotic plane was clear for dissection in most areas. Consequently, the incompletely resected tumor was removed en bloc (Fig. 2 lower). The resulting margins of the pia mater were reapproximated. Histological examination of the surgical specimen demonstrated a hypercellular tumor accompanied by significant cell atypism, pleomorphism, and mitotic figures, whereas no microvascular proliferation and rosette formation were observed (Fig. 3). Immunohistochemical staining was positive for glial fibrillary acidic protein, S-100 protein, synaptophysin, neuron-specific class III beta-tubulin, and INI-1. The MIB-1 labeling index was approximately 40% (Fig. 4). Those findings were compatible with PNET.

Postoperatively, his lower extremity motor weakness and sciatica improved remarkably, and he could resume ambulation with a brace. The saddle anesthesia, impaired rectal tone, and vesicorectal dysfunction did not change. He underwent fractionated radiotherapy of 50 Gy to the tumor site and 36 Gy prophylactically to the whole craniospinal axis. However, the tumor recurred locally 7 months after surgery. Additional radiotherapy of 36 Gy was administered to T7–T10 levels, but was unable to control tumor progression. The patient refused any form of chemotherapy. MR imaging performed 10 months after surgery demonstrated holocord progression and intracranial cerebrospinal fluid dissemination of the tumor (Fig. 5). The patient died 11 months after surgery, 13 months after the onset of disease. Autopsy findings revealed diffuse neoplastic infiltration of the cord parenchyma without identification of extracraniospinal lesions.

Discussion

Purely intramedullary PNET is a very rare entity which mainly affects children and young adults aged from 3 months to 29 years, with no significant sex predilection. The tumors may be located at any level of the spinal cord with insignificant predilection for the thoracic cord. Only one of the previous 11 cases had lesions involving the conus medullaris. The history of clinical presentation was short ranging from 6 days to 8 weeks. Our patient was a 39-year-old male with a lesion at the level of conus medullaris manifesting as rapid neurological deterioration for 2 weeks.

The treatment algorithm for spinal PNETs has not been determined. Many tumors have been treated with a combination of surgical resection/biopsy, chemotherapy, and
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Factors contributing to a good surgical outcome for intramedullary spinal cord tumors include benign histological subtype, complete resection, and satisfactory presurgical neurological status of the patient. A large series showed that high-grade intramedullary gliomas could not be completely removed and that postoperative functional status worsened in 61% of cases. However, that series did not contain any patients with PNET. In previous cases, the degree of tumor resection and prognosis were not significantly correlated. Further case accumulation is essential to understand intramedullary PNET. Our patient showed improvement in motor function after subtotal tumor resection, which may be primarily attributable to the tumor location in the conus medullaris that is not directly involved in skeletal motor function.

Our patient also underwent initial irradiation of 50 Gy to the tumor site with additional 36 Gy to the whole craniospinal axis following tumor resection. While these values were consistent with empirical doses administered in previous cases, intensive irradiation was only able to control this tumor for 7 months. As this case suggests, the role of radiotherapy in the treatment of spinal PNETs remains palliative, rather than curative.

Effective chemotherapeutic regimens for intramedullary PNETs have not been established, although combinations of current chemotherapeutic agents, such as vincristine, lomustine (CCNU), and cisplatin, adriamycin, etoposide (VP-16), and cyclophosphamide, vincristine, chloroethyl nitrosourea, and cisplatin, etoposide, carboplatin, and ifosfamide, as well as cisplatin, carboplatin, VP-16, cyclophosphamide, and high-dose methotrexate, have been attempted. No chemotherapy was administered because our patient rejected this treatment. Instead, he elected to undergo intensive radiation therapy.

Recent investigations have suggested that INI-1 immunohistochemistry is valuable for differentiating PNET from atypical teratoid/rhabdoid tumor, which is commonly associated with a myc gene amplification. In addition, anaplastic/large cell features and chromosome 2 and 8 radiotherapy, however, some cases were managed by surgical resection and serial chemotherapy or surgery followed by intensive radiation therapy due to the rarity of this condition and the lack of case-controlled studies, the most advantageous therapy to achieve the longest survival times, whether surgical resection, chemotherapy, radiotherapy, or various combinations, has not been determined.

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polysomy have been suggested to associate with more aggressive clinical behaviors.\(^3\) The present case demonstrated a highly malignant histological appearance, represented by cell atypism, pleomorphism, and mitotic figures combined with clinical aggressiveness. Unfortunately we did not perform gene exploration. Further experience is needed for the establishment of effective chemotherapeutic regimens for PNET.

PNET should be considered in the differential diagnosis of an intramedullary spinal cord tumor manifesting as rapid neurological deterioration. Radical resection at the initial surgery may be indicated for intramedullary tumors if located in the conus medullaris, even with malignant pathology, because of the significant possibility of postoperative neurological improvement and longer disease progression-free period. If the tumor is located at a level other than the conus medullaris, more modest surgery and adjuvant therapy may be indicated because radical treatment does not imply a better prognosis.\(^1,4-9,12\) Intramedullary PNET is presently not thought to be a curable disease, so treatment should aim at longer periods of tumor control, rather than jeopardizing functional neural tissue, to preserve the quality of life.

References

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